REMARKS / ARGUMENTS

In response to a final office action of June 20, 2006, Applicant has added a word to claims 1, 5 and 6 as suggested by the Examiner to clarify distinctions between the claimed invention and the cited references. Therefore, reconsideration and allowance of the specification and pending claims are respectfully requested.

I. Invention Overview

The invention subject to the present Application is a direct antifreeze cooled fuel cell power plant with passive water management that includes at least one fuel cell having a wetproofed anode support and a cathode support for directing reactant streams adjacent fuel cell catalysts. A porous anode cooler plate (26) has its fuel channels (28A, 28B, 28C, 28D) defined on a first surface and a plurality of coolant channels (32A, 32B, 32C, 32D) defined on an opposed second surface, and the anode cooler plate is secured so that its fuel channels are adjacent an anode support (20) to direct the fuel through the anode support to the anode catalyst. A porous cathode water management plate (38) has its oxidant channels (40A, 40B, 40C, 40D) secured adjacent a cathode support (24).

A direct antifreeze solution passes only through the coolant channels (32A, 32B, 32C, 32D) of the anode cooler plate (26) and does not flow through the cathode water management plate (38) so the solution cannot poison fuel cell catalysts

(14, 16). Fuel cell product water flows passively through the cathode water management plate (38) and water management channels (44A, 44B, 44C, 44D) defined in the plate (38) to humidify reactant streams and to be discharged from the fuel cell.

An impervious separator plate (36) is secured adjacent the coolant channels of the anode cooler plate for prohibiting movement of the direct antifreeze solution through the separator plate. Pressure control means maintain a positive pressure differential between the fuel stream passing through the fuel channels of the anode cooler plate and the direct antifreeze solution passing through the coolant channels of the anode cooler plate.

By use of the separator plate and the pressure control means, the direct antifreeze solution cannot leave the anode cooler plate to pass through the anode support to contact and poison the catalysts. However, the cathode water management plate permits fuel cell product water to move passively from the fuel cell catalysts into and through pores and water management channels of the cathode water management plate in fluid communication with a fuel cell water discharge to passively humidify the oxidant reactant stream and direct excess fuel cell product water out of the fuel cell power plant.

Extensive usage of the "direct antifreeze solution" of the present invention by the inventor and the assignee of all rights

in the present invention in prior art fuel cells gave rise to a need to further limit contact by the direct antifreeze solution on fuel cell catalysts. By use of the combined separator plate, pressure control means, and passive water movement through the cathode cooler plate, the present invention achieves water management of fuel cell product water, humidification of reactant streams, and efficient use of the direct antifreeze solution to tolerate sub-freezing ambient operating conditions without contaminating the catalysts with the direct antifreeze solution.

II. Response to Office Action

The undersigned thanks the Examiner for his generous expenditure of time in a telephone interview of June 21, 2006 regarding the final office action. It is the understanding of the undersigned that the Examiner agreed to consider and enter this Amendment because it embraces a suggestion made by the Examiner in the final office action, and upon closer examination of a reference discussed during the interview.

By the June 20, 2006 final office action, the Examiner has maintained his rejections of his January 25, 2006 first office action. In addition, the Examiner stated at Section 5, page 5, next to last sentence: "It is also noted that the impervious nature of the separator plate (36) in the instant specification is not recited in the independent claim." By the present amendment, the only independent claim, claim 1, has been amended to add the word "impervious" before the phrase "separator plate

(36)" at the beginning of sub-paragraph (d) of Claim 1. In addition, dependent claims 5 and 6 have been likewise amended to bring in the word "impervious" before the phrase "separator plate" to be consistent with the antecedent basis for the phrase in claim 1.

Antecedent bases for amendment of the phrase "separator plate (36)" to "impervious separator plate (36)" is found in the specification at page 4, lines 26 - 29; page 5, lines 30 - 34; page 9, lines 17 - 22 (adjacent reference numeral 36); and, page 10, lines 4 - 9 (adjacent reference numeral 36').

The undersigned hastens to stress that the amendment does not narrow independent claim 1 in any way. Instead the amendment simply clarifies that the "separator plate (36)" of original claim 1 is the same as the "impervious separator plate 36" found throughout the specification and that the "impervious separator plate" is "for prohibiting movement of the direct antifreeze solution through the separator plate". (Specification at page 4, lines 27 - 29; at page 19, claim 1, lines 29 - 31; and, at other locations in the specification.) Throughout the specification the phrases "impervious separator plate 36" and "separator plate 36" have been used interchangeably with reference to one component in FIG. 1, namely the "impervious separator plate 36". There is no other "separator plate" described in the specification or claims that permits passage of the direct antifreeze solution through the separator plate. Hence, it was always the intention of the

Applicant that the "separator plate 36" of original independent claim 1 is the "impervious separator plate 36" of the specification at page 9, lines 17, 18, or the "separator plate 36" of the specification at page 9, lines 22. In other words, the two phrases "impervious separator plate 36" and "separator plate 36" used in the specification and claims have the same meaning. Any possible doubt in that regard is now removed by the present amendment to the claims to add the word "impervious".

By the Final Office Action the Examiner has also responded to the arguments presented by the undersigned on behalf of the applicant in the April 28, 2006 Reply by insisting that "[t]he water transport plate adjacent to the anode water transport plate [shown in U.S. Patent 6,416,891 to Condit et al. (hereafter "Condit")] is considered to be a separator plate that does not allow the passage of antifreeze solution through the plate." (Final Office Action at Section 5, page 4, 4th paragraph.) More specifically, the Examiner asserted "the movement of the direct antifreeze solution is prohibited through the water transport plates. See Column 10, Lines 19 - 38 [of Condit]."

In the April 28, 2006 Reply to the first office action, the undersigned asserted that Condit did not show or suggest an impervious separator plate that prohibited movement of the direct antifreeze solution through the plate, and hence the prior art references did not show or suggest all of the claimed

limitations of independent claim 1. Indeed, the specification referred to Condit and several other "direct antifreeze solution" patents in the "Background Art" section as giving rise to performance that could be improved upon due to some limited contamination of the fuel cell catalysts by the direct antifreeze. (See Specification at Page 2, line 22 - Page 3, line 21.)

More specifically, the Specification pointed out that in operation of the prior "direct antifreeze" fuel cells of the prior art, "movement of fuel cell product water from the cathode catalyst through a "cathode support means" and into an adjacent "porous cooler plate" provides a liquid water pathway between the fuel cell catalysts and the direct antifreeze within the porous cooler plate. It is suspected that the direct antifreeze ultimately diffuses through that liquid water pathway to contact and poison the cathode catalyst, thereby decreasing fuel cell performance." (Specification at Page 15, lines 18 - 26." The present application solves that problem through use of the "impervious separator plate (36)" on only one side of the fuel cell and by flowing the direct antifreeze solution through only one side of the fuel cell, namely the through the "coolant channels (32A, 32B, 32C, 32D)" defined in the "porous anode cooler plate (26)". (See Claim 1, lines 15 - 26.). "By the present invention, no direct antifreeze coolant is directed to flow through the cathode water management plate 104, so the direct antifreeze cannot poison the cathode catalyst of the MEA 64." (Specification at Page 15, lines 26 - 30".

In his Final Office Action, the Examiner appears to be urging that in Condit, "once the pore volumes of the water transport plates are saturated with the cooling fluid …, the movement of the direct antifreeze solution is prohibited through the water transport plates" (Final Office Action, at Section 5, page 5, emphasis added.) In other words, by the pore volume of the water transport plates being filled with the "cooling fluid", movement of the direct antifreeze out of the "coolant channels" is restricted.

This reading of Condit misunderstands Condit in a substantial manner. The "cooling fluid" of Condit is the "direct antifreeze solution". As recited in Condit at Col. 10, lines 28 - 33: "By filling the open pore volume of the anode and cathode water transport plate 68, 74, the cooling fluid stream of the direct antifreeze solution forms a gas barrier or seal preventing the gaseous reducing fluid in the reducing fluid fuel channels 82 from flowing into oxidant channels in an adjacent cell." (Emphasis added.) Therefore, while the Condit anode and adjacent water transport plates provide a gaseous barrier, it is clear that the "open pore volume of the anode and cathode water transport plates 68, 74" are filled with "the cooling fluid", and that it is a "cooling fluid … of the direct antifreeze solution". (Condit, at Col. 10, lines 28 - 30.)

This language of Condit clearly establishes that the aforesaid assertion by the Examiner that "[t]he water transport plates [of Condit] adjacent to the anode water transport plate

is considered to be a separator plate that does not allow the passage of antifreeze solution through the plate" is inaccurate. (Final Office Action, at Section 5, page 4.) As recited above, the pore volume of the water transport plates of Condit are filled with a "cooling fluid stream of the direct antifreeze solution...." (Condit, at Col. 10, lines 29 - 30.) Because the pore volume of the plates of Condit are filled with the direct antifreeze solution, they therefore are not impervious and cannot prohibit movement of the direct antifreeze solution through the plates, in contrast to the "impervious separator plate" of the present application,.

Therefore, Condit does not show or suggest an "impervious separator plate" as recited in independent claim 1, as amended. Consequently, it is respectfully requested that Condit be removed as a reference. Because none of the prior art references show or suggest all claim limitations of the only independent claim, it is also requested that Claim 1 be allowed. Additionally, M.P.E.P. Sec. 214.03 states: "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." Because claim 1 should be allowable for reasons recited above, it is also requested that the Examiner's rejections of dependent claims 2 - 7 should also be removed and those claims also be allowed.

III. Conclusion

By the amendment and argument presented above it is respectfully urged that all of the Examiner's concerns raised in the June 20, 2006 final office action have been resolved. Accordingly, it is urged that that the Application is now in condition for allowance. Therefore, it is respectfully requested that the Examiner enter this Amendment, remove the rejections of the pending claims, and issue a Notice of Allowance.

Respectfully submitted,
Malcolm J. Chisholm, Jr.

Attorney for Applicants
Registration No. 33,665
Telephone: (413) 243-0551

Date: 8/21/2006